This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

THIS PAGE BLANK (USPTO)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 March 2001 (08.03.2001)

PCT

(10) International Publication Number
WO 01/15650 A1

(51) International Patent Classification[7]: A61F 13/535

(21) International Application Number: PCT/US00/40712

(22) International Filing Date: 21 August 2000 (21.08.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/385,132 27 August 1999 (27.08.1999) US

(71) Applicant: KIMBERLY-CLARK WORLDWIDE, INC. [US/US]; 401 North Lake Street, Neenah, WI 54956 (US).

(72) Inventor: TANZER, Richard, Warren; 413 Beaulieu Road, Neenah, WI 54956 (US).

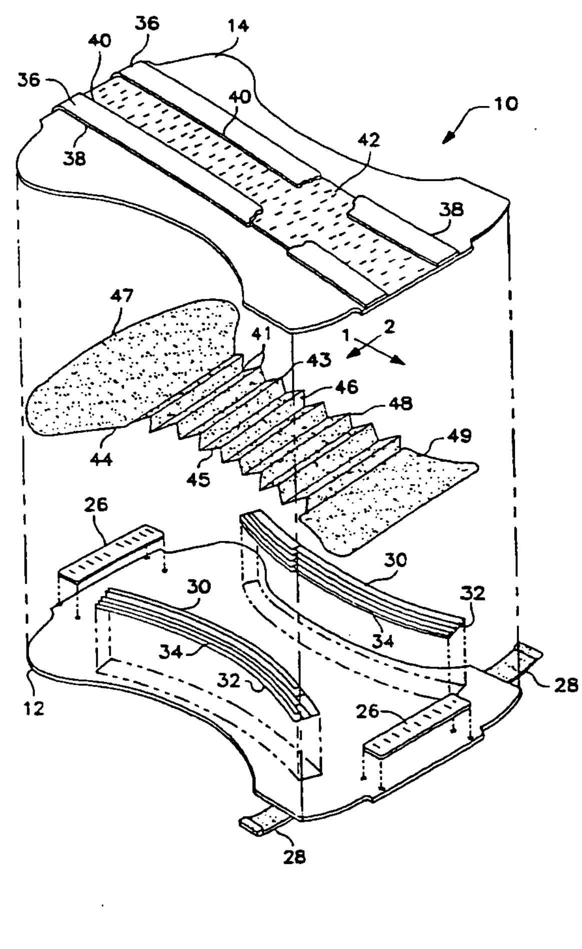
(74) Agents: PETERSEN, Maxwell, J.; Pauley Petersen Kinne & Fejer, Suite 365, 2800 West Higgins Road, Hoffman Estates, IL 60195 et al. (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: ABSORBENT ARTICLE HAVING PLEATED EXTENSIBLE ABSORBENT LAYER



(57) Abstract: An absorbent nonwoven composite material includes a plurality of pleats defined by fold lines in at least one region of the composite. The fold lines are oriented in a first direction. The absorbent nonwoven composite is stretchable in a second direction perpendicular to the fold lines, between a first position where the pleats are substantially folded and a second position where the pleats are substantially unfolded or extended. The absorbent nonwoven composite material is useful in a wide variety of absorbent articles where controlled regional stretching in a selected direction is desired.

WO 01/15650 A1

Published:

— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ABSORBENT ARTICLE HAVING PLEATED EXTENSIBLE ABSORBENT LAYER

FIELD OF THE INVENTION

This invention is directed to an absorbent article having a pleated extensible absorbent layer. The pleated absorbent layer is selectively stretchable in a direction perpendicular to the pleats.

BACKGROUND OF THE INVENTION

It is known to make absorbent articles, such as disposable diapers and pant-like absorbent garments, using stretchable materials. Some absorbent articles are rendered stretchable by placing elastic bands in the waist and leg regions, and otherwise employing inelastic construction materials. In some instances, absorbent articles have employed elastic or otherwise stretchable materials in constructing the primary layers. This approach has been limited because most absorbent articles include, at minimum, a liquid-permeable top layer, an absorbent core composite, and a substantially liquid impermeable outer cover material. The use of an elastic or stretchable material in one or more layers will not render the absorbent article stretchable unless each and every layer can be made from a similarly stretchable material. Often, the absorbent composite in the core is the least stretchable of the layers, and tears when the top layer and outer cover materials can be stretched to a greater degree.

Stretchable absorbent articles are disclosed, for instance in U.S. Patent 5,560,878 issued to Dragoo et al., and in U.S. Patent 5,645,542, issued to Anjur et al. In the disclosed articles, all of the layers are stretchable. Other stretchable absorbent articles are disclosed in U.S. Patents 4,847,134 and 5,376,198, both issued to Fahrenkrug et al. In these articles, some of the layers are more stretchable than others. The less stretchable outer layers form rugosites upon relaxation.

Perhaps the greatest challenge in making stretchable absorbent articles is the provision of an absorbent composite layer which is stretchable. Some of the most advanced absorbent composites, having the highest absorbencies, include relatively high percentages of absorbent and superabsorbent materials contained in a relatively lower percentage of nonwoven web filament matrix. Efforts to render these composites stretchable have focused on forming the nonwoven web filament matrix from elastic polymers. However, because the

matrix polymer is often a minor component of these highly loaded composites, the elastic matrix polymer has limited influence on the elasticity of the entire composite. Additionally, the matrix filaments can separate or tear during stretching.

Thus, there is a need or desire for absorbent composite layers having high loadings of absorbent and superabsorbent materials, which have controlled stretchability in desired directions.

SUMMARY OF THE INVENTION

The present invention is directed to a highly absorbent nonwoven web composite which addresses the foregoing concerns. The absorbent nonwoven composite includes a combination of nonwoven matrix fibers, superabsorbent particles or fibers, and, optionally, absorbent fibers. In one embodiment, the superabsorbent particles or fibers, and optional absorbent fibers, are contained within a nonwoven web, between the matrix fibers. In another embodiment, the superabsorbent polymers or fibers, and optional absorbent fibers, are contained between two of the nonwoven webs of fibers.

In accordance with the invention, the absorbent nonwoven web composite is pleated by forming folds at regular intervals. The folds defining the pleats are oriented perpendicular to a direction of desired stretching. Thus, when the absorbent article is stretched, the consequent unfolding and flattening out of the pleats permits limited but controlled stretching of the absorbent nonwoven web composite. The height or depth of the pleats influences the extent to which the absorbent nonwoven web composite may be stretched.

In another embodiment of the invention, only one or more isolated regions of the absorbent nonwoven web composite may be pleated, so as to facilitate stretching only in those regions. In still another embodiment, different regions of the absorbent web composite may be provided with pleats oriented in different directions. In each region, the pleats facilitate stretching of the composite in the direction perpendicular to the folds defining the pleats. In still another embodiment, the pleated absorbent nonwoven web composite may be intermittently bonded to a layer of elastic material. By providing an elastic backing, the pleated absorbent nonwoven web composite can be both extended and retracted, the latter occurring when a stretching force is removed.

BNSDOCID: <WO___0115650A1_I_>

The present invention is also directed to an absorbent article which utilizes the pleated absorbent nonwoven web composite, and which is stretchable in a direction perpendicular to the folds defining the pleats.

With the foregoing in mind, it is a feature and advantage of the invention to provide a pleated absorbent nonwoven web composite that has controlled stretching perpendicular to the folds defining the pleats.

It is another feature and advantage of the invention to provide a partially pleated absorbent nonwoven web composite having controlled stretching in the pleated region or regions.

It is also a feature and advantage of the invention to provide an absorbent nonwoven web composite having pleats oriented in different directions in different regions, wherein each pleated region is stretchable perpendicular to the folds defining the pleats in that region.

It is also a feature and advantage of the invention to provide an absorbent article having controlled stretching influenced by the pleated nonwoven web composite.

These and other features and advantages will become further apparent from the following detailed description of the presently preferred embodiments, read in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view of one embodiment of an absorbent article of the invention, in this case, a diaper.

Fig. 2 is a plan view of one embodiment of a pleated absorbent nonwoven web composite of the invention.

Fig. 3 is a plan view of another embodiment of a pleated absorbent nonwoven web composite of the invention.

DEFINITIONS

The term "nonwoven fabric or web" means a web having a structure of individual fibers or filaments which are interlaid, but not in an identifiable manner as in a knitted fabric. The terms "fiber" and "filament" are used herein interchangeably. Nonwoven fabrics or webs have been formed from many processes such as, for example, meltblowing processes, spunbonding processes, air laying processes, and bonded carded web processes.

The term also includes films that have been perforated or otherwise treated to allow air to pass through. The basis weight of nonwoven fabrics is usually expressed in ounces of material per square yard (osy) or grams per square meter (gsm) and the fiber diameters are usually expressed in microns. (Note that to convert from osy to gsm, multiply osy by 33.91.)

The term "microfibers" means small diameter fibers having an average diameter not greater than about 75 microns, for example, having an average diameter of from about 1 micron to about 50 microns, or more particularly, having an average diameter of from about 1 micron to about 30 microns.

The term "spunbonded fibers" refers to small diameter fibers which are formed by extruding molten thermoplastic material as filaments from a plurality of fine capillaries of a spinnerette having a circular or other configuration, with the diameter of the extruded filaments then being rapidly reduced as by, for example, in U.S. Patent Number 4,340,563 to Appel et al., U.S. Patent Number 3,692,618 to Dorschner et al., U.S. Patent Number 3,802,817 to Matsuki et al., U.S. Patent Numbers 3,338,992 and 3,341,394 to Kinney, U.S. Patent Number 3,502,763 to Hartman, U.S. Patent Number 3,502,538 to Petersen, and U.S. Patent Number 3,542,615 to Dobo et al. Spunbond fibers are quenched and generally not tacky on the surface when they enter the draw unit, or when they are deposited onto a collecting surface. Spunbond fibers are generally continuous and may have average diameters larger than 7 microns, often between about 10 and 30 microns.

The term "meltblown fibers" means fibers formed by extruding a molten thermoplastic material through a plurality of fine, usually circular, die capillaries as molten threads or filaments into converging high velocity heated gas (e.g., air) streams which attenuate the filaments of molten thermoplastic material to reduce their diameter, which may be to microfiber diameter. Thereafter, the meltblown fibers are carried by the high velocity gas stream and are deposited on a collecting surface to form a web of randomly dispersed meltblown fibers. Such a process is disclosed for example, in U.S. Patent Number 3,849,241 to Butin et al. Meltblown fibers are microfibers which may be continuous or discontinuous, are generally smaller than 10 microns in diameter, and are generally self bonding when deposited onto a collecting surface. Meltblown fibers used in the invention are preferably substantially continuous.

BNSDOCID: <WO___0115650A1_I_>

The term "substantially continuous filaments or fibers" refers to filaments or fibers prepared by extrusion from a spinnerette, including without limitation spunbonded and meltblown fibers, which are not cut from their original length prior to being formed into a nonwoven web or fabric. Substantially continuous filaments or fibers may have lengths ranging from greater than about 15 cm to more than one meter; and up to the length of the nonwoven web or fabric being formed. The definition of "substantially continuous filaments or fibers" includes those which are not cut prior to being formed into a nonwoven web or fabric, but which are later cut when the nonwoven web or fabric is cut.

The term "staple filaments or fibers" means filaments or fibers which are natural or which are cut from a manufactured filament prior to forming into a web, and which have a length ranging from about 0.1-15 cm, more commonly about 0.2-7 cm.

The term "fiber" or "fibrous" is meant to refer to a particulate material wherein the length to diameter ratio of such particulate material is greater than about 10. Conversely, a "nonfiber" or "nonfibrous" material is meant to refer to a particulate material wherein the length to diameter ratio of such particulate material is about 10 or less.

The terms "elastic" and "elastomeric" are used interchangeably to mean a material that is generally capable of recovering its shape after deformation when the deforming force is removed. Specifically, as used herein, elastic or elastomeric is meant to be that property of any material which upon application of a biasing force, permits that material to be stretchable to a stretched biased length which is at least about 25 percent greater than its relaxed unbiased length, and that will cause the material to recover at least 40 percent of its elongation upon release of the stretching elongating force. A hypothetical example which would satisfy this definition of an elastomeric material would be a one (1) inch sample of a material which is elongatable to at least 1.25 inches and which, upon being elongated to 1.25 inches and released, will recover to a length of not more than 1.15 inches. Many elastic materials may be stretched by much more than 25 percent of their relaxed length, and many of these will recover to substantially their original relaxed length upon release of the stretching, elongating force. This latter class of materials is generally beneficial for purposes of the present invention. The term "inelastic" refers to materials that are not elastic.

BNSDOCID: <WO 0115650A1 I

The term "recover" or "retract" relates to a contraction of a stretched material upon termination of a biasing force following stretching of the material by application of the biasing force.

The term "superabsorbent material" refers to a water swellable, water-insoluble organic or inorganic material capable, under the most favorable conditions, of absorbing at least about 20 times its weight, preferably at least about 30 times its weight in an aqueous solution containing 0.9% by weight sodium chloride. The term "absorbent material" refers to a material which absorbs from about 1 to less than 20 times its weight in an aqueous solution containing 0.9% by weight sodium chloride. INDA Standard Test Method IST 10.1 (95), entitled "Standard Test Method for Absorbency Time, Absorbency Capacity, and Wicking Time," published by INDA, Association of the Nonwoven Fabrics Industry, Cary, North Carolina, provides the basis for a suitable test method to measure absorbency. The "Absorptive Capacity Test (for small specimens)" may be used to determine the absorbency of a material for the purpose of the subject invention with the following two modifications: (i) IST 10.1 (95) specifies that water is to be used; substitute a 0.9% aqueous sodium chloride solution, (ii) IST 10.1 (95) specifies that a 5 gram sample is used. If necessary, a smaller sample, obtained from an absorbent product may be used instead.

The term "pulp fibers" refers to fibers from natural sources such as woody and non-woody plants. Woody plants include, for example, deciduous and coniferous trees. Non-woody plants include, for instance, cotton, flax, esparto grass, milkweed, straw, jute hemp, and bagasse.

The term "absorbent article" includes without limitation diapers, training pants, swim wear, absorbent underpants, adult incontinence products, feminine hygiene products and medical absorbent products (for example, absorbent medical garments, underpads, bandages, drapes, and medical wipes).

The term "machine direction" refers to a direction of primary orientation of fibers in a thermoplastic nonwoven web. Following extrusion of nonwoven web filaments, such as spunbond or meltblown filaments, the filaments are typically cooled and carried away on a conveying device or similar apparatus. The machine direction is the direction of

BNSDOCID: <WO___0115650A1_I_>

primary orientation assumed by the filaments in a nonwoven web, resulting from being drawn and carried away.

The term "transverse direction" refers both to directions perpendicular to the machine direction, and directions within plus or minus 45 degrees of perpendicular to the machine direction.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

The present invention is directed to a highly absorbent nonwoven web composite including a combination of nonwoven fibers, a superabsorbent material and, optionally, absorbent fibers. The absorbent nonwoven web composite is pleated in one or more regions thereof, and is stretchable in a direction perpendicular to the folds which define the pleats. The present invention is also directed to an absorbent article which utilizes the pleated absorbent nonwoven web composite.

Fig. 1 illustrates an exploded perspective view of a disposable diaper according to one embodiment of the invention. Disposable diaper 10 includes an outer cover 12, a body side liner 14, and an absorbent composite 44 between the outer cover 12 and body side liner 14. Attached to the outer cover 12 are waist elastics 26, fastening tapes 28 and leg elastics 30. The leg elastics 30 include a carrier sheet 32 and individual elastic strands 34. The body side liner includes containment flaps 36 having proximal edges 38 and distal edges 40. A surge management layer 42 is located between the proximal edges 38 of the containment flaps 36.

A possible construction method and materials of a diaper similar to the one illustrated in Fig. 1 are set forth in greater detail in commonly assigned U.S. Patent 5,509,915, issued 25 April 1996 in the name of Hanson et al., incorporated herein by reference. Possible modifications to the diaper illustrated in Fig. 1 are set forth in commonly assigned U.S. Patent 5,509,915 referenced above and in commonly assigned U.S. Patent 5,364,382, issued 19 November 1994 in the name of Matthews et al. Such possible modifications include positioning the surge management layer 42 between the body-side liner 14 and the absorbent composite 44 and reducing the length of the surge management layer to extend the length of the absorbent composite or massing (reduce length and increase basis

weight) the surge management layer in the area of the diaper where liquid waste initially accumulates (target zone).

Figs. 2 and 3 illustrate the pleated absorbent nonwoven web composite 44 in more detail. The composite 44 may include a single layer in which superabsorbent fibers or particles and, optionally, absorbent fibers are contained between the fibers in a nonwoven fibrous web. Alternatively, the composite 44 may include multiple layers, for instance, a sandwich structure in which the superabsorbent and optional absorbent fibers are sandwiched between two layers of nonwoven fibrous web. Composite 44 may have a basis weight of about 0.1-4.0 ounces per square yard (osy)(about 3.4-135 g/m^2), preferably about 0.2-2 osy (6.8-68 g/m^2.)

The illustrated absorbent composite 44 includes a central region 48 in between and adjacent to two end regions 47 and 49. Central region 48 corresponds to the crotch region when the diaper is being worn. End regions 47 and 49 correspond to back and front waist regions when the diaper is being worn. A plurality of pleats 43 are located in central region 48. Each pleat 43 is defined by first and second intersecting surfaces 45 and 46, joined at fold lines 41. The fold lines 41 are oriented in a lateral direction 2, which is substantially perpendicular to a longitudinal direction 1, which is the direction of stretching. In most instances, the direction of stretching will correspond to a machine direction defined during manufacture of the composite 44, and the orientation of fold lines 41 will correspond to a cross-machine direction.

The first and second surfaces 45 and 46 are generally rectangular, with each surface having a length equal to the width of the composite 44, and a width equal to the linear distance between the highest point and the lowest point on each pleat 43. This width, which is also referred to as the "surface depth" of the pleats, is an important factor in determining the amount of stretchability of the composite 44. The surface depth of pleats 43 is equal to the maximum actual depth of pleats 43 when they are folded together like an accordion, and is equal to one-half of the total width of pleats 43 when they are fully extended.

The width or "surface depth" of each rectangular surface 46 varies with the type and size of the absorbent article, and the amount of stretching required. Generally, the surface depth of pleats 43 (i.e., the shortest linear distance between the highest and lowest

BNSDOCID: <WO___0115650A1_I_>

points on each pleat) ranges from about 0.1-5 cm, suitably about 0.3-3 cm, desirably about 05.-2 cm. The pleats 43 may be formed using simple folding and pressing techniques.

In the embodiment of Fig. 2, only the central region 48 of absorbent composite 44 is pleated. The pleats permit or enhance longitudinal stretching only in the central region, and do not contribute to stretching in end regions 47 and 49. In the embodiment of Fig. 3, pleats 43 are present in the central and end regions. Pleats 43 in the central region 48 are defined by lateral folds 41, thereby facilitating longitudinal stretching in the central region. Pleats 43 in the end regions 47 and 49 are defined by longitudinal folds, thereby facilitating lateral stretching in the end regions. Other embodiments and pleating configurations are also possible depending on how much stretch is desired, in what direction, and where the stretch is desired.

In one embodiment, the absorbent composite 44 may be a coformed mixture of thermoplastic nonwoven filaments, superabsorbent fibers or particles, and absorbent fibers. In a coform process, at least one meltblown diehead is arranged near a chute through which other materials are added while the web is forming. Coform processes are described in U.S. Patents 4,818,464 to Lau and 4,100,324 to Anderson et al., the disclosures of which are incorporated by reference. The thermoplastic nonwoven filaments and absorbent and superabsorbent material may also be combined (i.e., mixed) using hydraulic entangling or mechanical entangling. A hydraulic entangling process is described in U.S. Patent 3,485,706 to Evans, the disclosure of which is incorporated by reference. After combining the ingredients, the absorbent elastic nonwoven composite may be bonded together using the through-air bonding or thermal point bonding techniques described above, to provide a coherent high integrity structure.

Alternatively, the absorbent structures can be formed as layered structures using two die tips to extrude the nonwoven filaments, and injecting the absorbent and superabsorbent materials as a middle layer between two elastomeric filament layers. Various degrees of mixing of nonwoven filaments and the absorbent/superabsorbent materials can be accomplished to facilitate regions of greater and lesser concentration of elastomeric filaments. This layered structure is an alternative to the absorbent structures produced by a coform process, in which the absorbent ingredients are substantially evenly distributed among individual filaments of an elastomeric nonwoven web.

In still another embodiment, the absorbent composite 44 may include a fibrous or particulate layer including superabsorbent material, in between two layers of a cellulose tissue. One such laminate is commercially available under the trade name GELOCK® 8026-33A/A from Gelock International Corporation located in Dunbridge, Ohio.

In still another embodiment, the absorbent composite may include two or more pleated sheets superimposed over one another and joined at the apexes of the pleats 43. Each pleated sheet may be an absorbent composite 44 as described above. Alternatively, when two or more layers are used, the superabsorbent particles or fibers may be contained between the pleated layers, instead of within the pleated layers. The combination of two or more pleated layers may then be extended and retracted like an accordion.

The nonwoven web component(s) of absorbent composite 44 may be a spunbond web, a meltblown web, a bonded carded web, an air laid web, a cellulose or pulp web, or any other microfibrous nonwoven web. Preferably, the nonwoven web is made of thermoplastic polymer fibers. The polymers useful to make the nonwoven web include without limitation polyethylene, polypropylene, copolymers of mainly ethylene and C_3-C_{12} alpha-olefins (commonly known as linear low density polyethylene), copolymers of mainly propylene with ethylene and/or C_4-C_{12} alpha-olefins, and flexible polyolefins including propylene-based polymers having both atactic and isotactic propylene groups in the main polypropylene chain, polyamides, and polyesters. Other suitable polymers include without limitation elastomers, for example polyurethanes, copolyether esters, polyamide polyether block copolymers, ethylene vinyl acetate copolymers, block copolymers having the general formula A-B-A' or A-B such as copoly (styrene/ethylene-butylene), styrene-poly (ethylene-propylene)-styrene, styrene-poly (ethylene-butylene)-styrene, polystyrene/ poly(ethylene-butylene)/polystyrene, poly (styrene/ethylene-butylene/styrene), and the like. Metallocene-catalyzed polyolefins are also useful, including those described in U.S. Patents 5,571,619; 5,322,728; and 5,272,236, the disclosures of which are incorporated herein by reference.

The superabsorbent material used in composite 44 may be in the form of fibers, particles, or combinations thereof. As explained above, the term "superabsorbent" or "superabsorbent material" refers to a water-swellable, water-insoluble organic or inorganic material capable, under the most favorable conditions, of absorbing at least about 20 times

BNSDOCID: <WO___0115650A1_I_>

its weight and, more desirably, at least about 30 times its weight in an aqueous solution containing 0.9 weight percent sodium chloride.

The superabsorbent materials can be natural, synthetic and modified natural polymers and materials. In addition, the superabsorbent materials can be inorganic materials, such as silica gels, or organic compounds such as cross-linked polymers. The term "cross-linked" refers to any means for effectively rendering normally water-soluble materials substantially water insoluble but swellable. Such means can include, for example, physical entanglement, crystalline domains, covalent bonds, ionic complexes and associations, hydrophilic associations, such as hydrogen bonding, and hydrophobic associations or Van der Waals forces.

Examples of synthetic superabsorbent material polymers include the alkali metal and ammonium salts of poly(acrylic acid) and poly(methacrylic acid), poly(acrylamides), poly(vinyl ethers), maleic anhydride copolymers with vinyl ethers and alpha-olefins, poly(vinyl pyrrolidone), poly(vinylmorpholinone), poly(vinyl alcohol), and mixtures and copolymers thereof. Further superabsorbent materials include natural and modified natural polymers, such as hydrolyzed acrylonitrile-grafted starch, acrylic acid grafted starch, methyl cellulose, chitosan, carboxymethyl cellulose, hydroxypropyl cellulose, and the natural gums, such as alginates, xanthan gum, locust bean gum and the like. Mixtures of natural and wholly or partially synthetic superabsorbent polymers can also be useful in the present invention. Other suitable absorbent gelling materials are disclosed by Assarsson et al. in U.S. Patent 3,901,236 issued August 26, 1975. Processes for preparing synthetic absorbent gelling polymers are disclosed in U.S. Patent No. 4,076,663 issued February 28, 1978 to Masuda et al. and U.S. Patent No. 4,286,082 issued August 25, 1981 to Tsubakimoto et al.

Superabsorbent materials may be xerogels which form hydrogels when wetted. The term "hydrogel," however, has commonly been used to also refer to both the wetted and unwetted forms of the superabsorbent polymer material. The superabsorbent materials can be in many forms such as flakes, powders, particulates, fibers, continuous fibers, networks, solution spun filaments and webs. The particles can be of any desired shape, for example, spiral or semi-spiral, cubic, rod-like, polyhedral, etc. Needles, flakes, fibers, and combinations may also be used.

Superabsorbents are generally available in particle sizes ranging from about 20 to about 1000 microns. Examples of commercially available particulate superabsorbents include SANWET® IM 3900 and SANWET® IM-5000P, available from Hoescht Celanese located in Portsmouth, Virginia, DRYTECH® 2035LD available from Dow Chemical Co. located in Midland, Michigan, and FAVOR® SXM880, available from Stockhausen, located in Greensboro, North Carolina. An example of a fibrous superabsorbent is OASIS® 101, available from Technical Absorbents, located in Grimsby, United Kingdom.

The optional absorbent fibers used in composite 44 may be any liquid-absorbing natural or synthetic fibers which are capable, under the most favorable conditions, of absorbing about 1 to less than 20 times their weight in an aqueous solution containing 0.9% by weight sodium chloride. Absorbent fibers include without limitation rayon staple fibers, cotton fibers, natural cellulose fibers such as wood pulp fibers and cotton liners, other pulp fibers, and fiberized feathers (e.g., fiberized poultry feathers, such as fiberized chicken feathers.)

Pulp fibers are especially useful as the absorbent fibers in the elastomeric nonwoven web composite. Preferred pulp fibers include cellulose pulp fibers, and the like. Other types of absorbent pulp may also be employed.

The composite 44 may include about 3-80% by weight of the nonwoven web filament matrix, about 10-80% by weight superabsorbent material, and 0-80% by weight absorbent fibers. Desirably, the composite 44 includes about 5-50% by weight of the nonwoven web filament matrix, about 25-75% by weight superabsorbent, and about 25-75% by weight absorbent fibers.

In one embodiment, the pleated absorbent composite 44 may be provided with elastic recovery by laminating the pleated absorbent composite 44 to an elastic sheet when the composite is retracted. When an elastic support sheet is employed, it will stretch when the pleated composite 44 is extended, and will retract when the stretching force is removed, causing retraction of the pleated composite 44. The elastic sheet may be a film, nonwoven web, or other material, and is preferably breathable to water vapor. Suitable polymers for making the elastic back sheet include without limitation vulcanized silicone rubber, polyurethane, polyether ester and polyether amide, styrene-butadiene copolymers and terpolymers, elastomeric ethylene-propylene copolymers, and elastomeric single-site or

BNSDOCID: <WO___0115650A1_I_>

metallocene-catalyzed ethylene polymers and ethylene-alpha olefin copolymers. The absorbent composite 44 may be intermittently bonded to the elastic support layer using a variety of known techniques, including thermal bonding, ultrasonic bonding, adhesive bonding, mechanical stitch bonding, and the like.

In order for the diaper 10 to have overall stretchability similar to the pleated absorbent composite 44, the other layers of the diaper must be at least as stretchable. Both surge layer 42 and body side liner 14 are constructed from highly liquid pervious materials. These layers function to transfer liquid from the wearer to the absorbent composite 44. Suitable materials include porous woven materials, porous nonwoven materials, and apertured films. Examples include, without limitation, any stretchable porous sheets of polymeric fibers, bonded carded webs of synthetic or natural fibers or combinations thereof. Either layer may also be an apertured stretchable plastic film.

The outer cover 12 may include a single stretchable layer, or may include multiple stretchable layers joined together by adhesive bonding, thermal bonding, ultrasonic bonding or the like. Outer cover 12 can be made from a wide variety of woven or nonwoven material, films, or a film-coated nonwoven material, including, for instance, cast or blown films. Outer cover 12 may also be a composite of a bonded carded or spunbonded or meltblown material, for example, a spunbonded-meltblown composite of thermoplastic material or a spunbonded-meltblown-spunbonded thermoplastic material, wherein the spunbonded layer can provide a cloth-like texture and the meltblown layer can provide liquid impermeability. Outer cover 12 is preferably highly breathable to water vapor.

While the embodiments of the invention disclosed herein are presently considered preferred, various modifications and improvements can be made without departing from the spirit and scope of the invention. The scope of the invention is indicated by the appended claims, and all changes that fall within the meaning and range of equivalency are intended to be embraced therein.

I CLAIM:

1. An absorbent article, comprising:

a liquid-permeable body side liner;

a substantially liquid-impermeable outer cover; and

an absorbent nonwoven composite material between the body side liner and the outer cover;

the absorbent composite material comprising a plurality of pleats defined by fold lines;

the absorbent composite material being stretchable in a direction perpendicular to the fold lines.

2. The absorbent article of Claim 1, wherein each of the pleats comprises two substantially rectangular surfaces.

3. The absorbent article of Claim 1, wherein the pleats have a surface depth of about 0.1-5 cm.

4. The absorbent article of Claim 1, wherein the pleats have a surface depth of about 0.3-3 cm.

5. The absorbent article of Claim 1, wherein the pleats have a surface depth of about 0.5-2 cm.

6. The absorbent article of Claim 1, wherein the absorbent nonwoven composite material comprises a central region and two end regions, and pleats in the central region defined by laterally oriented fold lines.

7. The absorbent article of Claim 6, wherein the end regions are substantially free of pleats.

8. The absorbent article of Claim 6, wherein the end regions comprise pleats defined by longitudinally oriented fold lines.

9. The absorbent article of Claim 1, wherein the absorbent nonwoven composite comprises a mixture of thermoplastic nonwoven filaments and superabsorbent particles or fibers.

10. The absorbent article of Claim 9, wherein the absorbent nonwoven composite further comprises absorbent fibers.

11. The absorbent article of Claim 1, wherein the absorbent nonwoven composite comprises an inner layer of superabsorbent particles or fibers and two outer layers of nonwoven fibers.

12. The absorbent article of Claim 11, wherein the outer layers comprise cellulose tissue.

13. The absorbent article of Claim 11, wherein the outer layers comprise thermoplastic nonwoven filaments.

14. The absorbent article of Claim 11, wherein the inner layer further comprises absorbent fibers.

15. An absorbent nonwoven composite material having a central region and two end regions, comprising a plurality of pleats defined by laterally oriented fold lines, the absorbent nonwoven composite being extendable in a longitudinal direction between a first position where the pleats are folded, and a second position where the pleats are extended.

16. The absorbent nonwoven composite of Claim 15, wherein the pleats defined by longitudinally oriented fold lines are present in the central region.

17. The absorbent nonwoven composite of Claim 15, further comprising a plurality of pleats defined by longitudinally oriented fold lines.

18. The absorbent nonwoven composite of Claim 17, wherein the pleats defined by longitudinally oriented fold lines are present in at least one of the end regions.

19. A laminate including an elastic back sheet bonded to the absorbent nonwoven composite of Claim 15.

20. A diaper comprising the absorbent nonwoven composite of Claim 15.

21. Training pants comprising the absorbent nonwoven composite of Claim 15.

22. Swim wear comprising the absorbent nonwoven composite of Claim 15.

23. Underpants comprising the absorbent nonwoven composite of Claim 15.

24. An adult incontinence article comprising the absorbent nonwoven composite of Claim 15.

25. A feminine hygiene product comprising the absorbent nonwoven composite of Claim 15.

26. A medical absorbent product comprising the absorbent nonwoven composite of Claim 15.

BNSDOCID: <WO___0115650A1_I_>

27. An absorbent article, comprising:

a liquid-permeable body side liner;

a substantially liquid-impermeable outer cover; and

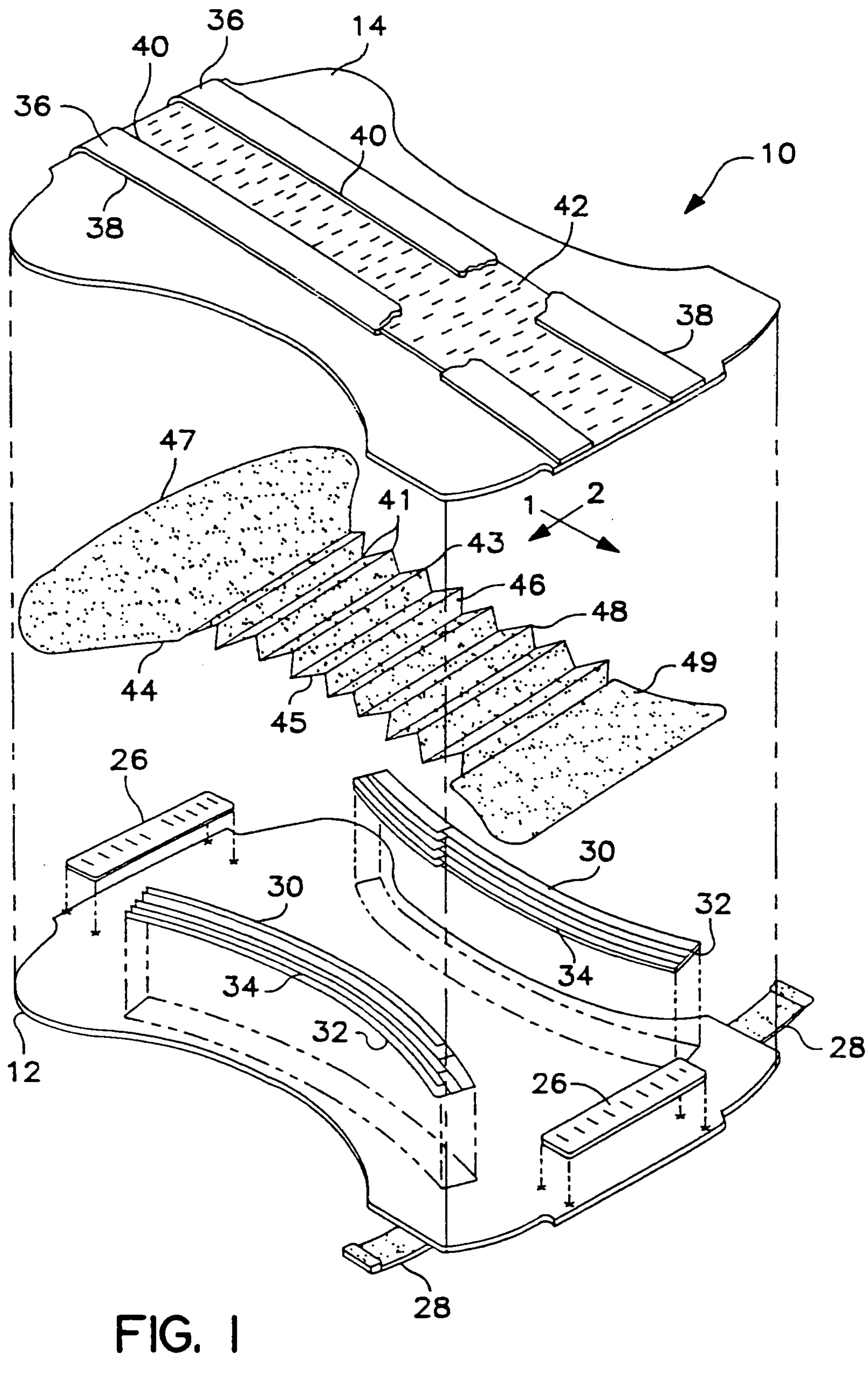
an absorbent layer between the body side liner and the outer cover;

at least one region of the absorbent layer comprising a plurality of pleats defined by fold lines oriented in a lateral direction;

the absorbent article being stretchable in a longitudinal direction in said region.

28. The absorbent article of Claim 27, wherein at least one other region of the absorbent layer comprises a plurality of pleats defined by fold lines oriented in the longitudinal direction;

the absorbent article being stretchable in the lateral direction in said other region.



36
14
40
36
40
10
38
42
38
47
1
2
41
43
46
48
49
44
45
26
30
30
32
34
34
32
28
12
26
28

FIG. 1

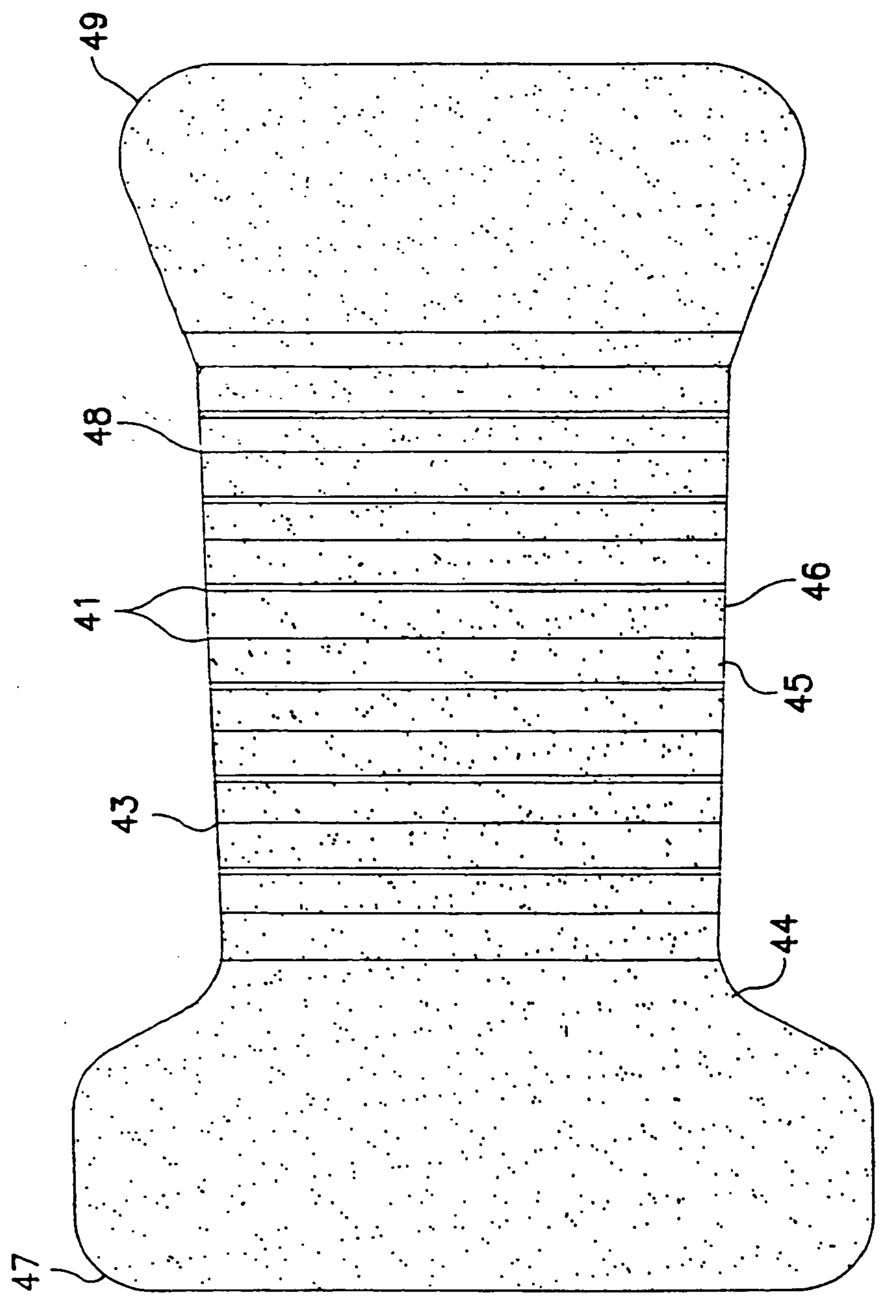


FIG. 2

BNSDOCID: <WO 0115650A1 I >

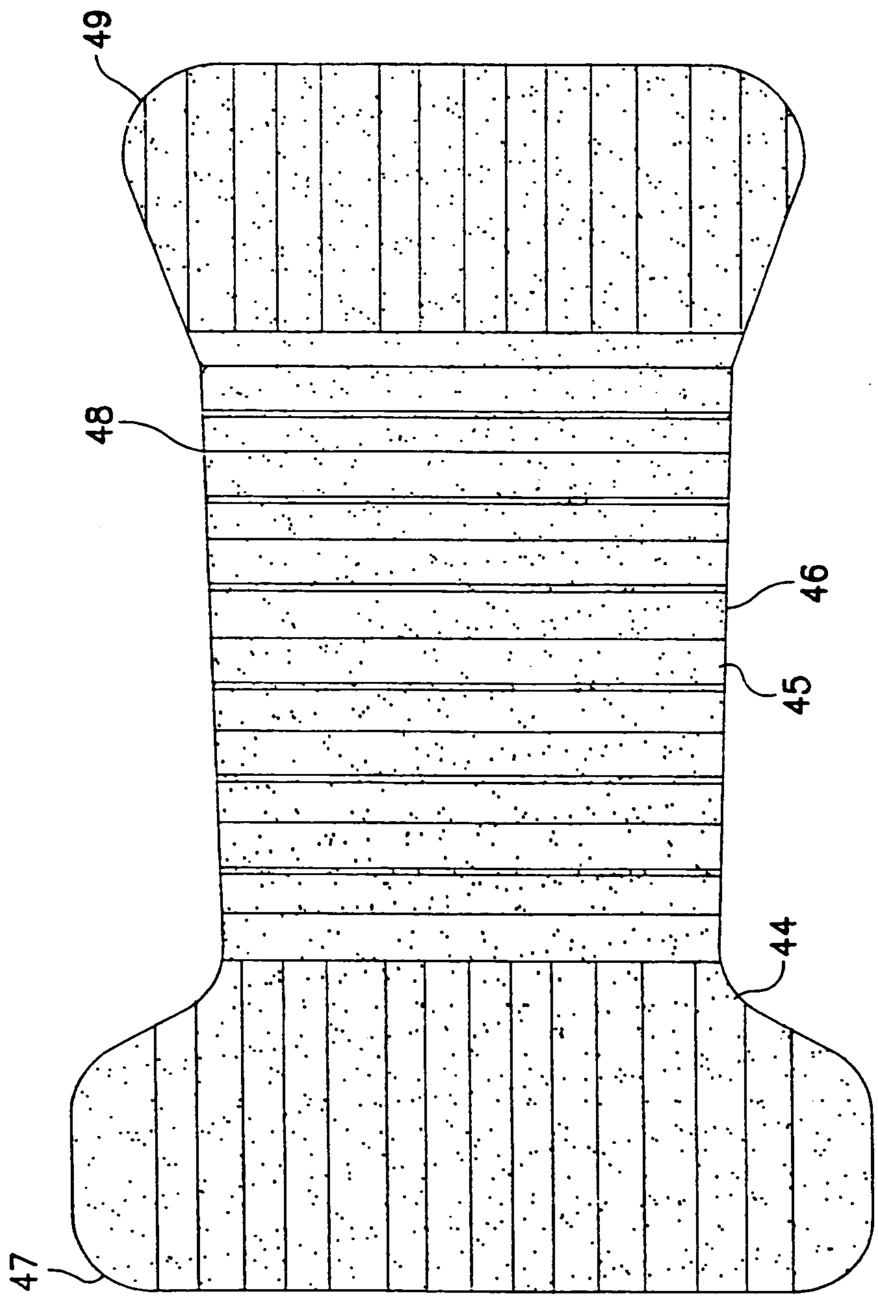


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/40712

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61F13/535

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 504 799 A (VERDOY FURSY) 5 November 1982 (1982-11-05) page 5, line 7 - line 15; claims; figures	1-8,15, 17,18, 20-28
X	WO 96 05786 A (MCNEIL PPC INC) 29 February 1996 (1996-02-29) page 6, line 7 -page 7, line 31; claims 1-21; figures	1-7,15, 20-26
X	US 3 561 446 A (JONES JOHN LESLIE SR) 9 February 1971 (1971-02-09) column 2, line 55 - line 64; claims; figures	1-5, 20-26
A		8,15-18

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 December 2000	28/12/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Mirza, A

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int .tional Application No
PCT/US 00/40712

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 653 382 A (EASLEY CHARLES E ET AL) 4 April 1972 (1972-04-04) column 4, line 15 - line 62; claims; figures	1-5, 20-26
A		11,12
A	DE 564 904 C (VERFÜRTH ADOLFINE) 24 November 1932 (1932-11-24) the whole document	1-7,15, 25,27

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ational Application No
PCT/US 00/40712

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2504799 A	05-11-1982	NONE	
WO 9605786 A	29-02-1996	AT 194478 T	15-07-2000
		AU 3538595 A	14-03-1996
		BR 9508733 A	02-06-1998
		CA 2197870 A	29-02-1996
		DE 69518012 D	17-08-2000
		EP 0801549 A	22-10-1997
		ES 2147855 T	01-10-2000
		FI 970704 A	16-04-1997
		JP 10504488 T	06-05-1998
		PT 801549 T	31-10-2000
		US 5702381 A	30-12-1997
US 3561446 A	09-02-1971	US 3847702 A	12-11-1974
		US 3610244 A	05-10-1971
US 3653382 A	04-04-1972	BE 760610 A	21-06-1971
		CA 940283 A	22-01-1974
		DE 2062790 A	01-07-1971
		FR 2075886 A	15-10-1971
		GB 1312370 A	04-04-1973
		NL 7018696 A	24-06-1971
		SE 384131 B	26-04-1976
DE 564904 C		NONE	